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PENSOFT

New records of *Diplomys labilis* (Bangs, 1901) (Mammalia, Rodentia, Echimyidae) from Nicaragua

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Abstract
The Rufous Tree Rat *Diplomys labilis* is distributed from southwestern Costa Rica to northern Ecuador. We report the first 2 records of this species from southern Nicaragua, extending the known geographical distribution for the species about 280 km northward from its nearest known locality, in Costa Rica. We provide photos of both Nicaraguan individuals, which were observed almost a year apart in the same locality, the Refugio Bartola Private Reserve, Río San Juan Department.

Key words
Indio-Maíz; Lowland Wet Forest; Nicaraguan mammals; range extension; Río San Juan; Rufous Tree Rat.

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Introduction

The Rufous Tree Rat, *Diplomys labilis* (Bangs, 1901), is a secretive, nocturnal, and strictly arboreal mammal, formerly known to occur from central Panama to northern Ecuador, from sea level to elevations up to 1,500 m (Eisenberg and Thorington 1973, Villa-R. et al. 1993, Reid 2009, Emmons and Patton 2015, Tirira 2017). Recently, Ramírez-Fernández et al. (2015) recorded the presence of this species on the Osa Peninsula in southwestern Costa Rica. Currently, 2 subspecies are recognized (Handley 1966, Emmons and Patton 2015): the insular *D. labilis labilis* and the mainland *D. labilis darlingi*.

Diplomys labilis is listed as Least Concern under the International Union for Conservation of Nature (IUCN) criteria in view of its wide distribution in Panama, occurrence in a number of protected areas, and because it is unlikely to be declining at the rate required to qualify for listing it in a threatened category (Delgado and Emmons 2016). However, the species does not seem to be common in mainland territory and only a few records are available from Costa Rica, Colombia, and Ecuador (Ramírez-Fernández et al. 2015, Emmons and Patton 2015).

Here we report a new locality for the Rufous Tree Rat from southern Nicaragua, outside its known geographical distribution. We also add a new species for the country, according to the last published Nicaraguan checklist (Medina and Saldaña 2012).

Methods

During a mammal watching tour on February 2, 2016, at approximately 20:20 h, we observed from a boat an

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Figure 1. A, B. Two photographs of the same individual of *Diplomys labilis* observed in February 2016. **C.** A photograph of a second individual of *D. labilis* (ASNHC-18436) captured in January 2017, all from Bartola River, Río San Juan, Nicaragua. Photograph A by Philip Telfer, B by Karen Baker, and C by José Gabriel Martínez-Fonseca.

adult female *D. labilis* (Fig. 1A, B) near the Bartola River. This small river constitutes the border between the Refugio Bartola Private Reserve and the Indio-Maíz Biosphere Reserve. We were about 1 km north of the mouth of the Río San Juan River, in the Río San Juan Department located in southern Nicaragua. The rat was actively moving on a branch of a Zotacaballo tree (*Zygia longifolia*) about 3 m above the water. After about 4 minutes of direct observation, it disappeared from sight into the canopy. The tree's total height was estimated at about 12 m, although the forest in the surrounding area has a significantly higher canopy (35–40 m). The general area corresponds to Lowland Wet Forest (Holdridge 1967) with abundant arboreal vegetation and epiphytes.

We arranged a second trip in order to capture and closely examine an individual of *D. labilis* on January 28, 2017. About 80 m downstream and under almost identical general conditions from the 2016 sighting, we collected a male individual *D. labilis* (preserved in the Angelo State Natural History Collection under the number ASNHC-18436; Fig. 1C). We preserved the whole specimen in fluid with skull in place, therefore skull measurements could not be taken. We followed procedures in Dunnum et al. (2017) for fluid preservation and collecting DNA samples for future study. Collection permit DGB-IC-058-2017 was provided by the personnel of MARENA (Ministerio de Ambiente y Recursos Naturales) Managua, Nicaragua. The specimen was found about 6 meters above the water on a branch of another Zotacaballo tree, which this time had seeds, although we did not observe the rat eating them. One of us climbed the tree and the rat jumped into the river, where it was caught by hand while swimming towards the shore. We took photos (Fig. 1C) and measurements of the individual, as follows: head and body length 225 mm; tail length 240 mm; hind foot length 41 mm; ear length 16 mm; and weight 282 g. Specimen ASNHC-18436 (Fig. 1C) appeared to be smaller than the 2016 individual (Fig. 1A, B). Age differences could explain the differences in size between both individuals. The rat had 2 ticks on the posterior portion of its left ear.

Results

New records. Nicaragua, Río San Juan Department, near the Bartola River (10.97315°N 84.33056°W; 40 m a.s.l.), at the border between the Refugio Bartola Private Reserve and the Indio-Maíz Biosphere Reserve. Fiona A. Reid, José Gabriel Martínez-Fonseca, Julio Loza, Luis Gutiérrez-López, Philip Telfer, and Karen Baker. February 2, 2016 (photographic evidence) and January 28, 2017 (ASNHC-18436).

Identification. Identification of the 2017 individual was possible on the basis of morphological traits, following Reid's (2009) field guide. It is important to mention that the author, Fiona A. Reid, personally saw and identified the 2016 Nicaraguan individual on site. In our photographs (Fig. 1), it is possible to distinguish for both the individuals that the rostrum is darker and grayer than the body. Other features noted were short snout, small ears, small white patches behind the ears, absence of spines, a thick and hairy tail, which is longer than head-body length. In addition, and unlike other Echimyid rats known in the area (*Hoplomys gymnurus* and *Proechimys semispinosus*), which have sharply demarcated white underparts, the Rufous Tree Rat has cream underparts with a soft color transition from upperparts. It also shares the following features with the mainland subspecies *D. labilis darlingi* (Goldman 1912): lips and muzzle mouse-gray; upperparts ochraceous-buff; limbs like upperparts; ankles and feet grayish; and tail blackish brown all around, covered with short, upright whitish hairs. The combination of these morphological characters is unique to *D. labilis* in this region.

Discussion

This new locality represents the northern- and western-most distributional record for the species and the first

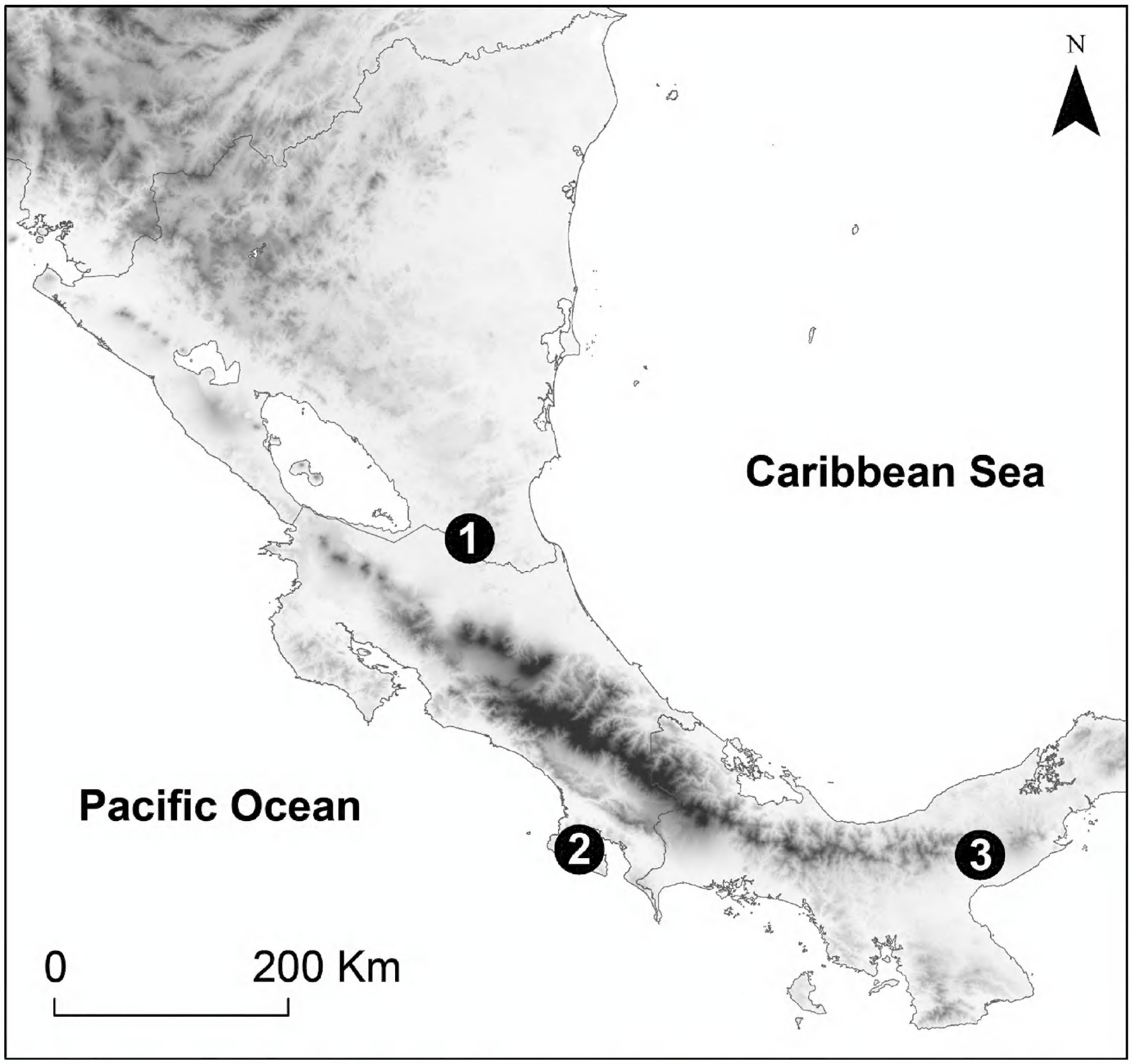

Figure 2. Map of Nicaragua, Costa Rica, and Panama showing: 1) our *Diplomys labilis* records from Bartola River, Río San Juan, Nicaragua; 2) its geographically closest *D. labilis* record from Osa Peninsula, Costa Rica (Ramírez-Fernández et al. 2015); and 3) the second closest record from Santa María, Penonomé District, Panama (Villa-R. et al. 1993).

country record for Nicaragua, extending its known range ca 280 km northward from the closest record on Osa Peninsula, southwestern Costa Rica (Ramírez-Fernández et al. 2015; Fig. 2). Although *D. labilis* was not included in the list of mammals expected to occur in Nicaragua (Medina-Fitoria and Saldaña 2012), it has been listed as a species expected to occur in the northern Atlantic lowlands of Costa Rica (Villalobos-Chaves et al. 2016).

Because of its secretive, arboreal, and nocturnal habits, the Rufous Tree Rat is very hard to observe or trap and is normally missed in most surveys (Tesh 1970). We believe this to be the main reason why its distribution has been underestimated in Central America, however, further sampling will likely fill in the gaps in the distribution range of this species throughout western Panama and eastern Costa Rica. Based on forest similarities (Dinerstein et al. 1995), *D. labilis* may be even found at localities further northward along the wet and moist lowland Nicaraguan Caribbean versant, particularly in the proximity of rivers.

We consider our 2 different observations as indicative of the existence of a permanent population of *D. labilis* in the area rather than isolated fortuitous sightings. The general area is well preserved mostly due the presence of a small military base and the existence of the Refugio Bartola Private Reserve. However, in late November 2016, hurricane Otto violently struck southeastern Nicaragua, causing considerable damage to the forest structure along the Río San Juan (Brown 2016). The population status of the Rufous Tree Rat is largely unknown, and this species is found in evergreen and deciduous forest, mangroves, plantations, and secondary growth (Reid 2009). Although we saw 1 *D. labilis* individual before and another after hurricane Otto, it is conceivable that this hurricane may have had an impact on the population of this rodent.

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